

# EXPLOSIVES SAFETY

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## HAZARD ANALYSIS FOR AMMUNITION OPERATIONS

AR 385-10, 23 May 88, The Army Safety Program, requires the development of standing operating procedures (SOPs) for all operations involving risk of death, injury, or loss of property. The purpose of this requirement is to ensure that workers have the information required to perform the task safely and that practices and procedures to minimize accident risks are incorporated into the operation to ensure its safe completion. DAP 385-64, 28 Nov 97, Ammunition and Explosives Safety Standards, requires the completion of an operational or task hazard analysis (HA) prior to writing a new SOP for ammunition or explosives operations.

A HA consists of a systematic, step-by-step, documented review of the entire explosive operation. It is used to identify credible hazardous conditions for the purpose of assigning compensating measures and controls to completely eliminate or reduce them to an acceptable risk level. Risk assessment codes (RAC), as discussed in AR 385-10, are assigned to each hazard before and after compensating measures are applied. These compensating measures (specific procedures to follow, personal protective equipment, engineering controls, training, supervision, etc.) must be included at the step of the operation to which they apply.

Personnel conducting the HA must be knowledgeable in ammunition and explosives safety, the task to be performed, and methods used in the HA. A widely used format for the HA is of the columnar type. It consists of

several columns describing the operation (or step) being performed, the type of hazard, its cause(s), resulting effect(s), RAC before abatement procedures, abatement procedures, and RAC after abatement procedures.

The completed HA must be provided to the installation Hazard Analysis Working Group (HAWG) for their evaluation. They review the document for content adequacy and suitability and make necessary changes to complete the HA. Once the HA is approved by the HAWG, it is used for the development of the SOP. The HA becomes a permanent part of the approved SOP after staffing. In accordance with AMC-R 700-107, 8 May 92, Preparation of Standing Operating Procedures (SOPs) for Ammunition Operations, both documents must be submitted by AMC installations to USATCES for review.

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**TO CONTINUE TO  
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SAFETY BULLETIN,  
COMPLETE AND  
RETURN THE FORM  
FOUND IN THE  
BACK OF THIS  
BULLETIN.**

## STORAGE OF SMALL AMOUNTS OF HIGH EXPLOSIVES

The U.S. Army Technical Center for Explosives Safety (USATCES) has received numerous requests for assistance in storing small amounts of high explosives in limited areas, for example, the storage of a canine explosives scent kit at or near an airport. For quantities of non-fragment producing explosives under 100 lbs. net explosives weight (NEW), DAP 385-64, paragraph 5-5c(3), 28 Nov 97, Ammunition and Explosives Safety Standards, requires an inhabited building distance (IBD) separation of 670 feet. On occasion, the required 670 feet is not available. The following are approved explosives safety solutions that require less than 670 feet for IBD:

a. Navy Explosives Ordnance Disposal (EOD) Quick Response Ready Storage Locker System – this system has one or a few explosives items packed in a metal tool box that has pumice filled inserts for the explosives items. These containers are then placed on the floor of a commercially available aboveground magazine. When these containers are used as specified and placed in the required aboveground magazine, the kit has no quantity distance arcs. The maximum credible event is 0.625 lbs. of hazard class (HC) 1.1 explosives (1/2 of an M112 C-4 block) and the Navy approval memo does require a separation of 30 feet to unrelated personnel. We have the technical data package for this system.

b. There is a commercial magazine design called the “Golan”. There are two versions of the Golan. One of which can store 11 lbs. (5 kgs) of non-fragmenting explosives and another designed for 22 lbs. (10 kgs). The 11 lbs. version has an IBD arc of 20 feet. Give us a call for a POC regarding the two Golan magazines.

c. The Navy developed a small earth covered magazine (ECM) for the storage of the canine explosives scent kit. The magazine can store 20 lbs. of non-fragment producing explosives and has a 110 foot IBD arc. We refer to this design as the Bow-Wow bunker. We have a technical data package on the Bow-Wow bunker.

d. The U.S. Army Defense Ammunition Logistics Activity (AMMOLOG) designed an improved Bow-Wow bunker called the “Mini-Mag”. This magazine has a main compartment and two adjacent side compartments for storing small amounts of incompatible items. There are two variations. The first variant has a 100 lb. limit on the main compartment with a 187 foot IBD arc. The second variant has a 300 lb. limit on the main compartment with a 268 foot IBD arc. A technical data package is available on the “Mini-Mag”.

e. AMMOLOG has researched the results of a detonation of 500 lbs. NEW inside a container express (CONEX). The research indicates that up to 500 lbs. of non-fragment producing HC 1.1 ammunition can be stored in a CONEX and when stored in accordance with the technical data package, the CONEX requires a 360 foot IBD arc. A technical data package on this storage concept is also available upon request.

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## EXPLOSIVES ACCIDENTS – THEY HAPPEN!

### ORDNANCE – EXPLOSIVES – AMMUNITION (OEA)

The following terms/definitions describe characteristics closely associated with the functioning of OEA.

#### DEFLAGRATE:

- To burn, to consume.
- To burn rapidly, with intense heat and dazzling light.

#### DETONATE:

- To explode violently and noisily.

#### EXPLODE:

- To cause to change suddenly and violently from a solid or liquid to a quickly expanding gas.

#### BRISANCE:

- The shattering effect of the sudden release of energy, such as in an explosion.

#### OEA ACCIDENT:

- A happening that is not expected, foreseen, or intended.
- An unpleasant and unintended happening.
- Sometimes resulting from negligence.
- That results in injury, loss, and/or damage.

During fiscal year (FY) 1998, the Department of the Army experienced 17 reported explosives accidents/incidents. Thirteen of those explosives accidents resulted in one fatality and physical injury to 21 persons.

The reported 17 explosives accidents in FY 98, categorized as to severity, are as follows:

**CLASS A: (4 each)**

- Damage cost of \$1,000,000 or greater.
- Injury/illness resulting in fatality or permanent disability.
- Department of Defense (DOD) aircraft, missile, or spacecraft is destroyed, lost, or abandoned.

**CLASS B: (4 each)**

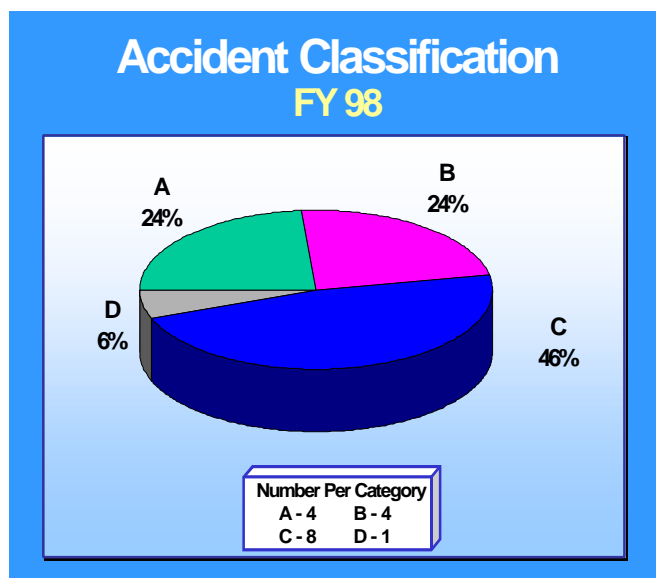
- Damage cost of \$200,000 to less than \$1,000,000.
- Injury/illness resulting in permanent partial disability.
- Three or more persons hospitalized.

**CLASS C: (8 each)**

- Damage cost of \$10,000 to less than \$200,000.
- Injury/illness resulting in lost time beyond day/shift.

**CLASS D: (1 each)**

- Damage cost of \$2,000 to less than \$10,000 to repair, clean up, or replace.
- Injury/illness requiring first aid only, no lost time.



**ACCIDENT CLASSIFICATION:**

The majority (95%) of the FY 98 injury related accidents were attributable to one or a combination of:

- Poor supervision.
- Inadequate training.
- Curiosity.
- Negligence.

**FAILURE TO FOLLOW DEVELOPED AND COMMON SENSE PROCEDURES, WHILE HANDLING OR UTILIZING OEA, INCREASES THE OPPORTUNITY FOR AN OEA ACCIDENT!**

In the strongest terms, **“THE INJURIES AND LOSS OF LIFE WERE PREVENTABLE”!**

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**HAZARDS OF UNEXPLODED ORDNANCE (UXO)**

In early spring of 1999, a 12-year old boy was killed in his home while playing with a munition item carried home by his father. This again raises concern that dangerous UXO is taken off ranges and impact areas. Other live military ordnance that his father had collected was recovered from the house. This tragic event almost seems unimaginable.

Yet, in 1995, a somewhat similar incident took place. Five children between the ages of 7 and 15 were injured when two 40MM grenade rounds that they were playing with detonated at their residence. The explosives (seven 40MM rounds) had been taken from an impact area at an Army installation during the family's vacation and brought to their home in Memphis. The children were playing with the rounds when one HE and one smoke detonated. Two of the children were critically injured with head and stomach wounds, while the other three received numerous minor injuries.

Unit leaders routinely educate their personnel on the dangers of UXO, usually during field training and especially when training at ranges or “live fire” training facilities. Explosives ordnance disposal (EOD) personnel are commonly called in to provide briefs on these occasions. This is also stressed by Range Safety, Range

Control, and Quality Assurance Specialist (Ammunition Surveillance) (QASAS). The Army recognizes the risks in such manuals as FM 21-16, 30 Aug 94, UXO Procedures. However, what does it take to get this point across?

Accountability for expended ammunition is routinely followed in a number of ways; from inventory of ammunition on the range, to shakedowns following completion of firing. However, we still hear war stories of soldiers that have “appropriated” live ammo – whether it be simulators, 5.56MM rounds, 40MM rounds, and the list goes on and on. Everyone probably has their own story on what they have seen recovered in barracks inspections or returned to the ammunition supply point (ASP) from a unit inspection. The question is, just what can we do to deter people from taking or collecting trophies of ammunition and UXO?

Another related aspect for consideration is that parents routinely educate their children on the dangers of poisons, electrical hazards, crossing busy streets, etc. When living close to a military installation or ammunition facility, we need to ensure that explosives safety also becomes a part of educating our children, just as we do with our troops.

For those of you that haven’t experienced what it is like to see someone “first hand” that has been injured/killed by an unexploded munition, it is not something that you can ever erase from your mind. It’s hard to imagine how these parents will ever deal with this loss.

We are asking for your help and ideas. Just what more can “we” do? An example of some ideas we would like some feedback on is:

- How often do these incidents occur that we never hear about?
- What more can we do to educate personnel, to include children?
- Do our soldiers receive enough training on UXO/ammunition hazards?
- Do we need to inspect barracks and vehicles more often?
- What motivates these individuals to collect “live” ammunition?

- What has worked at your installation to reduce this risk?

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Be Aware and Obey Posted Signs!

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## DO YOU HAVE IDEAS FOR ARTICLES INVOLVING EXPLOSIVES SAFETY?

Good ideas for explosives safety are everywhere! If there is a topic you would like to see researched or published in a future Explosives Safety Bulletin, e-mail us at: [cummings@dac-emh2.army.mil](mailto:cummings@dac-emh2.army.mil) or [durand@dac-emh2.army.mil](mailto:durand@dac-emh2.army.mil).

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## AID IN AVOIDING A HAZARDOUS EVENT

“Those who cannot remember the past are condemned to repeat it.” (George Santayana, from Life of Reason, 1905.)

For safety to be proactive, it is necessary to evaluate not only that which could develop in the future, but also those accidents that have occurred in the past. It is by looking at past incidents, whether they were class A, B, C, or D that we establish requirements for the future. These requirements help prevent accidents from happening again.

Risk management is dependent upon analyzing and utilizing accident data. From accident reports, information is gathered on the time, what happened, class of accident, the type and class of ammunition, the accident's primary and secondary causes, its impact, as well as, corrective actions taken to prevent a recurrence.

By not filling out an accident report completely, the responsible organization penalizes the U.S. Army by not having the data necessary for "Lessons Learned" and to utilize this data to prevent future occurrences. The alternative is to continue learning through the school of hard knocks, resulting in preventable injury or even death.

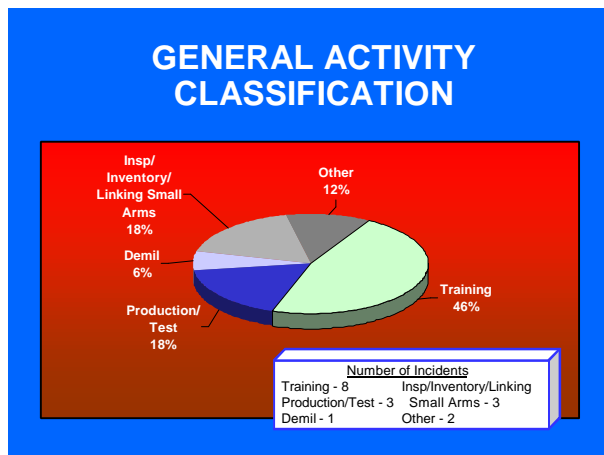
So, the next time you fill out an accident report, think about the use of this data and its use for the future. Think about the future young men or women who can be saved from an accident. Let's prevent the next person from not knowing and paying the price – FILL OUT THE DA FORM 285 CORRECTLY AND COMPLETELY!

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## EXPLOSIVES ACCIDENTS IN TRAINING ON RANGES

Explosives are effective in damaging physical objects – buildings, bridges, weapons – as well as, killing and wounding people. The devastating effectiveness of explosives can be witnessed almost daily on the evening news. Utilizing ammunition effectively requires live fire training on ranges. This training is inherently high risk.



In FY98, eight (nearly half) of the reported explosives accidents involved training on ranges. Seven of these eight were the consequence of training with explosives charges. The eighth involved a non-briefed, non-explosives ordnance disposal (EOD) service member (SM) handling unexploded ordnance (UXO).

Evaluation of the causes of the eight indicated that these accidents were attributable to "human error". Causes varied from using a 50 caliber bullet as a hammer, to holding onto a detonation cord while it functioned, and to carrying UXO off range where it inadvertently functioned. These events should not have happened. A common sense approach is: If you did not drop it or see your buddy drop it, DON'T PICK IT UP!

Since UXO maims and kills, all personnel allowed on the ranges need to be properly trained on hazards associated with UXO. Inappropriate behavior includes disturbing UXO or collecting such devices for souvenirs. The location of discovered UXO should be marked and Range Control should be notified.

Range safety information can be found in AR 385-63, 15 Nov 83, Policies and Procedures for Firing Ammunition for Training, Target Practice, and Combat. AR 385-63 directs the installation commander to establish a range safety program that includes, but not limited to, appointing qualified personnel, publishing local standing operating procedures (SOPs), and surveying and maintaining the ranges.

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## IF IT WORKS WHERE YOU ARE, SHARE THE WEALTH!

If there is some aspect of an explosives safety program or briefing that has worked well at your duty station, we would be happy to pass the word to the readers of this publication. E-mail us at [cummings@dac-emh2.army.mil](mailto:cummings@dac-emh2.army.mil) or [durand@dac-emh2.army.mil](mailto:durand@dac-emh2.army.mil).

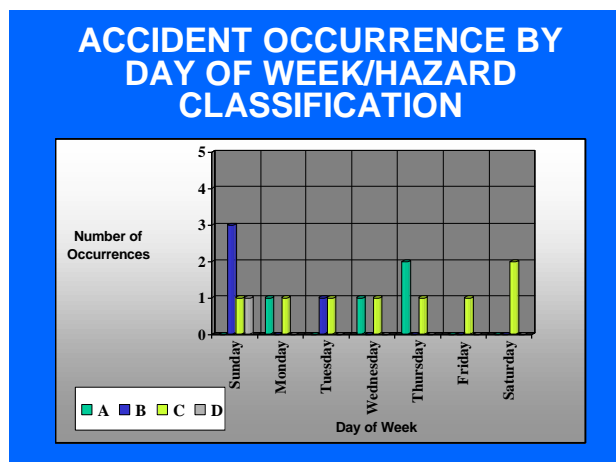


## SAFETY, THERE IS NO TIME FOR REST!

In looking at the explosives accident data for FY98, we were surprised to find that many occurred on or around the weekends. There are seven days in the week and safety must be an integral part on each of those days. It doesn't matter if you are at home doing yard work or out on training maneuvers with your National Guard unit, accidents can happen that can cause injury or death.

Training is essential for mission readiness, but many times it is a high risk activity. In order for training to be effective, training is done to the degree and intensity at which soldiers would fight. There is truth to the adage, "Train the way you will fight".

The following chart gives a breakdown of the classification of the accidents by day of the week. They have been separated in this manner to help us see if there are any patterns. A pattern could represent a clue as to where additional emphasis may be needed.



If properly conducted, one would expect that there should be no more risk associated with training on Saturday and Sunday than there is on any other day of the week. Yet, in 1998, accidents on the weekend accounted for seven out of eight (87.5%) of the accidents on training ranges. Additional analysis will be conducted to evaluate data from at least the past 5 years of explosives accidents.

Remember, weekend operations require the same supervision, control, and oversight!

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## CURIOSITY KILLED THE... AIRMAN

Curiosity. It can make the world an exciting and interesting adventure, or it can end that adventure.

Explosive devices are used around all military operations and many civilian construction projects. Too often, when curiosity meets an explosive device, death or injury results.

### What happened.

The unit deployed to a testing range to collect air samples as part of a larger test. Their mission was to set up several mobile sample collection sites. Once set up, each two-person team would then change sample collectors and filters according to a time schedule, and would ensure that their equipment operated properly throughout the collection period.

Between filter and sample changes, there wasn't much for the team to do. Some participants brought correspondence course materials to read; others brought paperback novels or magazines. One team, however, decided to explore the local area during their down time.

The team set up near a main road. A large white trailer and two dummy bomb casings on trailers were in the field just east of their position. To their south, several hundred meters away, was a large fenced-in area. After changing their samples, the team members decided to walk around the site. The NCOIC walked across the road to examine the trailer and bomb casings, while his assistant walked south. About 150 meters from the collection site, the assistant saw a cylindrical yellow object on the ground. He picked it up to examine it, and then tossed it back to the ground. The object, an unexploded cluster bomb submunition, detonated as it hit the ground, killing him.

### Why it happened.

There were two primary causes of this accident. First, the victim's chain of command did not train him on the hazards of unexploded ordnance (UXO). He had graduated from initial entry training a few months prior to this mission. He was also a last minute addition to the mission and missed most of the pre-deployment training. The make-up training that he received did not include anything about the hazards of UXO and the proper actions to take if UXO was discovered.

Also, the organization sponsoring the test did not require the participants to receive any training on UXO hazards. They did require them to receive training on the weather, animal, and equipment hazards peculiar to the test site. This particular installation had been frequently used in the past to conduct testing of explosives and munitions, and the post's Explosives Ordnance Disposal (EOD) team had a thorough briefing on UXO hazards available to anyone who requested it. But in this case, the sponsoring agency did not request the class.

#### **Corrective actions.**

Leaders, you are responsible for your troops! Be sure to include the risks associated with UXO when conducting your risk assessments. If your training or testing site has been used for live munitions or demolitions firing in the past, consider the possibility of UXO in the area. If you are operating near a known impact area, expect UXO in the area. If an area has been used before, or has received a surface sweep for UXO, do not automatically assume it is completely free of dangerous objects. Erosion or shifting sands can uncover previously buried items, or someone could throw an item acquired elsewhere into your area.

Control measures available include training and site reconnaissance. FM 21-16 (UXO Procedures) and the Soldiers Manual for Common Tasks (STP-21-1-SMCT) contain procedures and training materials for identifying and reacting to UXO hazards. If you are operating at an unfamiliar location, ask range control, local EOD, or your sponsoring agency if there is any UXO orientation training available specific to this location or installation.

Prior to occupying a training or mission location, be sure to check it for UXO hazards. Quartering party SOPs usually require a sweep of the area to ensure its suitability for occupation. If you are in a known high-risk area, use your available detection equipment before declaring an area safe to move through or occupy. If you are conducting a real-world mission, be sure to get the latest intelligence on the area and its land mine and UXO status from your S-2 and any previous users of the site.

And finally, emphasize to your soldiers during safety briefings not to touch, kick, or otherwise disturb objects found in their environment.

This isn't just a cliché—curiosity killed our sample operator because his leaders did not emphasize UXO hazards to him. Our soldiers deserve better than this.

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## **DEFENSE ENVIRONMENTAL RESTORATION PROGRAM (DERP) FOR FY 99 FOR FORMERLY USED DEFENSE SITES (FUDS), BASE REALIGNMENT AND CLOSURE SITES (BRACS), AND INSTALLATION RESTORATION PROGRAM SITES (IRPS)**

The U.S. Army Technical Center for Explosives Safety (USATCES), in partnership with the U.S. Army Corps of Engineers (USACE), Rock Island District, continues support of the U.S. Army Engineering and Support Center, Huntsville (USAESCH) with that part of the DERP program which addresses the assessment and cleanup activities of ordnance and explosives (OE) at FUDS, IRP, and BRAC properties.

Primary support provided by the USATCES/USACE, Rock Island District, OE Archives Search Report (ASR) team is development of an ASR for each assigned site. The ASR includes a historical records search (HRS) and review, site inspection (SI), ordnance evaluation, and preparation of a technical report. An integral part of this process is the HRS and review conducted for each site by members of the ASR team. Federal, state, and local government sources, as well as non-government sources, are contacted to obtain information used during SIs and in the preparation of the technical report. Report information includes the following: site history; types of ordnance used at the site; location of ordnance and/or explosives; impact areas; range fans; climate; hydrology; geology; historical and current aerial photographs; site maps, newspaper articles; previous studies; environmental assessments; ownership, including plat maps; records of real estate transactions showing War Department, Navy Department, or Department of Defense (DOD) usage; boring logs; and cultural resources, including endangered species; and interviews with knowledgeable persons.

*Former installations and locations to be inspected during FY 99 are:*

Kofa National Wildlife Refuge, AZ  
Palo Alto Precision Bombing Range (PBR) #3, AZ  
Palo Alto PBR #4, AZ  
Palo Alto PBR #5, AZ  
Palo Alto PBR #6, AZ  
Task Force Furnace, AZ  
President Lincoln's Circle of Forts:  
Fort Bayard, Wash, DC  
Fort Bunker Hill, Wash, DC  
Fort Chaplin, Wash, DC

Fort Davis, Wash, DC  
 Fort DeRussy, Wash, DC  
 Fort Greble, Wash, DC  
 Fort Kearny, Wash, DC  
 Fort Lincoln, Wash, DC  
 Fort Mahan, Wash, DC  
 Fort Ricketts, Wash, DC  
 Fort Slemmer, Wash, DC  
 Fort Slocum, Wash, DC  
 Fort Snyder, Wash, DC  
 Fort Stanton, Wash, DC  
 Fort Stevens, Wash, DC  
 Fort Totten, Wash, DC  
 Fort Wagner, Wash, DC  
 Muroc NAS (MCAS, Mohave), CA  
 Santa Catalina Island Bombing Range, CA  
 Stinson Beach Fire Control Station, CA  
 Travis AFB, CA  
 Campville Satellite Field, FL  
 MacDill AFB, FL  
 Sopchoppy PBR, FL  
 Fort Wheeler, GA  
 Glynco Naval Air Station, GA  
 Kennesaw Mountain Artillery Range, GA  
 Thomasville Bombing and Gunnery Range, GA  
 Nantucket Memorial Airport, MA  
 Gosnold AMTB 933, MA  
 Duck Island Dive Bombing Target, ME  
 Fort Baldwin Fire Control Station, ME  
 Sioux Army Depot, NE  
 Dennis Creek Range, NJ  
 Maurice Cove Naval Bombing and Strafing Target, NJ  
 Kirtland AFB PBR #3, Target N-6, NM  
 Kirtland AFB PBR #4, Target N-7, NM  
 Kirtland AFB PBR #8, Target N-11, NM  
 Kirtland AFB PBR #14, Target S-1, NM  
 Kirtland AFB PBR #15, Target S-2, NM  
 Kirtland AFB PBR #16, Target S-3, NM  
 Kirtland AFB PBR #17, Target S-4, NM  
 Kirtland AFB PBR #19, Target S-6, NM  
 Kirtland AFB PBR #20, Target S-7, NM  
 Kirtland AFB PBR #21, Target S-8, NM  
 Kirtland AFB PBR #22, Target S-9, NM  
 Paddy Auxiliary Landing Field, NM  
 Isleta Pueblo Ordnance Impact Area, NM  
 Fort Niagara, NY  
 New York Ordnance Works, NY  
 Pope AFB, NC  
 Portland Air Base, OR  
 Roseburg Rifle Range, OR  
 Desecheo Island, PR  
 Vieques Naval Ammunition Depot, PR  
 Fort Varnum, RI  
 Charleston AFB, SC

Mitchell PBR #3, SD  
 Rapid City Air-to-Ground Gunnery Range, SD  
 Rapid City SAA Range, Annex, SD  
 Sioux City PBR #6, SD  
 Badlands Bombing Range, SD  
 Columbia Auxiliary Air Field, WA

*Anyone having information on these installations is requested to forward materials or suggestions to:*

Director  
 U.S. Army Technical Center for Explosives Safety  
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## **U.S. ARMY TECHNICAL CENTER FOR EXPLOSIVES SAFETY (USATCES) HOTLINE**

The USATCES hotline number has been changed to DSN 956-6140 or commercial 918-420-6140. This 24-hour hotline was established to better serve the needs of the explosives/ammunition community. Callers are invited to submit any problems, comments, and suggestions to the above number.



**THE USATCES EXPLOSIVES SAFETY BULLETIN (ESB) IS  
CHANGING TO ELECTRONIC DISTRIBUTION FORMAT.**

IF YOU CURRENTLY RECEIVE THE ESB VIA HARD COPY AND WISH TO  
CONTINUE TO RECEIVE THE ESB VIA ELECTRONIC FORMAT, PLEASE  
COMPLETE THIS FORM AND RETURN IT ASAP.

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**Explosives Safety Technical Library**

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Datafax Commercial (918) 420-8705  
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